Commercial Space Committee

Update

Presented to the NASA Advisory Council

February 10, 2011

Commercial Committee Members

- Bretton Alexander, Chair
  - President of the Commercial Spaceflight Federation
- Lon Levin, Vice Chair
  - Co-founder of XM Satellite Radio and other satellite businesses
- Maj Gen Donald Hard (USAF, Ret.)
  - Independent consultant to government and industry
- Bernard A. Harris, Jr., (M.D.)
  - CEO of Vesalius Ventures, former NASA astronaut, and former SPACEHAB executive
- J. Michael Lounge
  - Former NASA astronaut and former Boeing executive
- Patti Grace Smith
  - Former FAA Associate Administrator for Commercial Space Transportation and consultant/advisor to space and aerospace companies
- Wilbur C. Trafton
  - Former NASA Associate Administrator for Space Flight and executive at ILS and Kistler Aerospace
- *John Emond, Executive Secretary*
  - *NASA Innovative Partnerships Program, Office of Chief Technologist*

Work Plan (Draft)

1. Review and advise on how best to optimize NASA's organizational elements and address cultural issues to effectively encourage and promote the development of a commercial space industry.

2. Review NASA's strategy and plans for stimulating a commercial space industry, and provide advice on effective and appropriate methods for NASA to stimulate, encourage and partner with commercial space. What is the logical progression for developing a commercial capability for transportation to ISS and LEO?

3. Review and advise on NASA's strategy for partnering and cooperating with other federal agencies on commercial space.

4. Provide advice on how NASA should define "commercial space" to effectively implement "commercial space" programs and policies.

Meeting Schedule

- Commercial Committee meetings held:
  - February 16, 2010, at NASA Headquarters in Washington, DC
  - March 30, 2010, at NASA Headquarters
  - April 26, 2010, at Johnson Space Center
  - June 17, 2010, at NASA Headquarters
  - July 8, 2010, fact finding at Kennedy Space Center
  - July 29, 2010, at NASA Headquarters
  - September 13-14, 2010, at Johnson Space Center
    - September 14, joint meeting with NAC Space Operations Committee
  - December 14, 2010, at NASA Headquarters
    - Joint meeting with NAC Education & Public Outreach Committee

- Upcoming meetings:
  - March 2011 at NASA Headquarters – *tentative*

Observations/Findings/Recommendations

- Observations
  - *Progress of the COTS Program* – “moving forward at a deliberate pace”
- Findings
  - *Use of Space Act Agreements* – “is appropriate for the proposed Commercial Crew Transportation program “
- Recommendations
  - *Defining the NASA Market* – “assess and clarify NASA’s expected traffic model”
  - *Concept of Operations and Acquisition Approach* – “specify the minimum and maximum number of seats to and from the ISS NASA would purchase”
  - *FAA Licensing* – “engage the FAA as soon as possible…with the goal of providing clarity to potential offerors regarding the regulatory framework “
  - *Business Case* – “continue to develop internal metrics and milestones to oversee…Commercial Crew “

Budget Update – *FY11 NASA Authorization Bill*

	FY11	FY12	FY13
Commercial Crew Development Program (CCDev + CCDP)	312 *500*	500 *1,400*	500 *1,400*
Commercial Orbital Transportation Services (COTS)	300 *312*	--	--
Commercial Reusable Suborbital Research (CRuSR)	15	15	15

- Commercial Resupply Service (CRS) for cargo resupply of ISS contracted at $3.5 b
  - SpaceX – 12 missions over 2011-15
  - Orbital – 8 missions over 2011-15

- As passed by the Senate and House
- As compared to President's FY11 Budget Request (PBR), released Feb. 1 (Shown in *italics)*
- 3-yr Authorization vs. 5-yr PBR
- Senate Appropriations mark slightly different (e.g., Commercial Crew $250m in FY11)

Commercial Crew Update

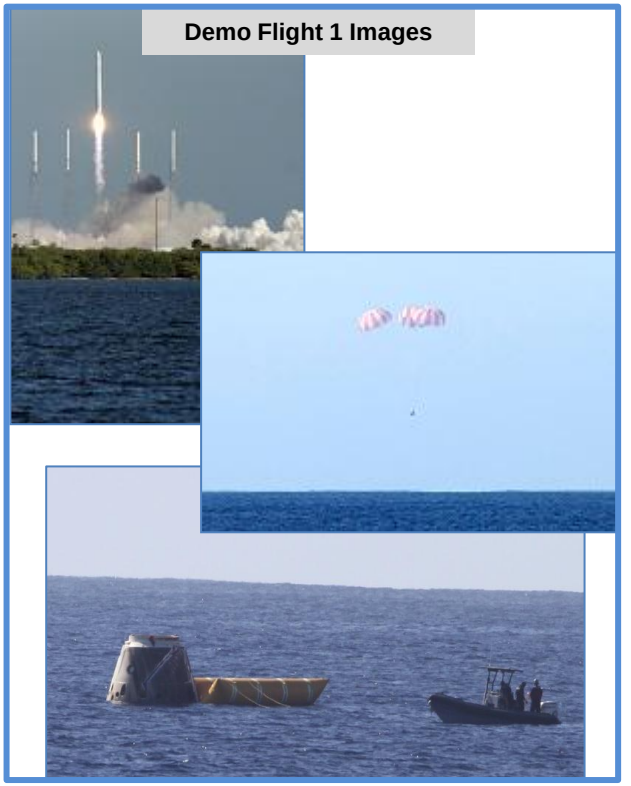
- Authorization Bill:
  - Establishes Commercial Crew as the "primary means" of transporting NASA astronauts to/from the International Space Station
  - Provides $1.3 billion over three years for development of commercial capabilities
    - Sen. Nelson stated Commercial Crew would be "fully funded over 6 years" vs. 5 years, i.e. $5.8 b
  - Requires publication of human rating requirements within 60 days, and reports to Congress on acquisition strategy and commercial markets prior to initiating full-up Commercial Crew Development Program

- CCDev 2 (Commercial Crew Development Round 2) proposals submitted Dec 13
  - CCDev 1 provided $50 million in Recovery Act funding for Commercial Crew technology acceleration
    - 5 companies awarded Space Act Agreements (SAAs)
      - Sierra Nevada Corporation, United Launch Alliance, Blue Origin, Paragon Space Development Corp., The Boeing Company
  - CCDev 2 to use FY11 Commercial Crew funding to fund "significant maturation of commercial crew systems"
  - Selections to be made in March

SpaceX Status

- 22 of 26 milestones completed for payments to date of $278M out of $298M.
- Demo Flight 1 successfully accomplished on December 8, 2010.
  - Falcon 9 launch and Dragon insertion to orbit
  - Dragon separation
  - Safe reentry
- Demo Flight 2 mission planned for June 2011.
  - Rendezvous and proximity operations with ISS
  - ISS communication demonstration
- Demo Flight 3 mission planned for September 2011.
  - Berthing operations with ISS
  - Cargo transfer demonstration
- NASA is evaluating SpaceX's proposal to combine Flights 2 and 3.

Falcon 9 Maiden Flight, Cape Canaveral



Demo Flight 1 Images

Orbital Status

- 18 of 22 milestones completed for payments to date of $177.5M out of $190M total.
- Cargo Integration Demo, completed at Thales Alenia in Italy Dec 1-3.
- AJ-26 engine hot fired at Stennis Space Center.
- Ground infrastructure at Wallops Flight Facility under construction.
- COTS Demo Flight planned for October 2011, demonstrating:
  - Launch vehicle operations
  - Cygnus orbital operations
  - ISS proximity and berthing operations
  - ISS departure and destructive re-entry ops
- NASA may add an additional Demo Flight as part of the 2011 Augmentation budget.

NK-33 1st Stage Engine Testing

Launch Pad Construction at WFF

Pressurized Cargo Module

CRuSR Update

- Commercial Reusable Suborbital Research (CRuSR)
  - Purpose is to fly science, technology, and education payloads on low-cost commercial suborbital vehicles
- NASA Authorization Bill provides $15 m a year for next three years
- CRuSR initial awards made in August 2010
  - $475K split between Masten Space Systems ar Armadillo Aerospace
  - 3-4 flights of vehicles in fall and winter 2010
  - Test flight environments and envelope

Discussion and Recommendations

Definition of Commercial

From the National Space Policy (June 28, 2010) –

Commercial Space Guidelines

- The term “commercial,” for the purposes of this policy, refers to space goods, services, or activities provided by private sector enterprises that bear a reasonable portion of the investment risk and responsibility for the activity, operate in accordance with typical market-based incentives for controlling cost and optimizing return on investment, and have the legal capacity to offer these goods or services to existing or potential nongovernmental customers.

Capability Based Commercial Services Procurement

- **Short Description of the Proposed Recommendation:** The NASA Advisory Council recommends that for the development activity, NASA present its commercial crew transportation service requirements (e.g., the 1130 document) as goals, with the clear understanding that the closer the offerors get to achieving them, the more likely they are to be awarded a service contract. In the end, this approach might give NASA more options and allow more CSP's to participate. It does require that NASA's programs (ISS in the near term, Beyond LEO Exploration in the long term) be open to adjusting their own architectures and conops to take maximum advantage of commercial sector capabilities. A commercial approach begins with an attitude that asks the question "let's see what these guys can do", rather than "Let's see if these guys can satisfy my total and specific mission requirements as I know them today."

Capability Based Services Procurement (cont.)

- **Major Reasons for Proposing the Recommendation:** The NASA Advisory Council observes that a traditional "hard and fast" program requirements driven procurement strategy might result in severely constraining what commercial crew services could be provided by Commercial Service Providers (CSP's). A relevant counter example is the ISS CRS procurement; wherein each CSP was allowed to bid for a subset of the ISS cargo transportation work based the schedule, capability and capacity of its particular delivery system. No single provider was expected to deliver all categories or possible configurations of cargo (pressurized/unpressurized/up/down). Of course there was a lot of competitive pressure to offer as much and as soon as possible, but since it was not an "all or nothing" procurement, NASA ended up with a more robust set of choices. Human transportation is of course a lot more complex, but a "capability based" service acquisition approach could offer significant advantages both to NASA and to the nascent commercial space industry.
- **Consequences of No Action on the Proposed Recommendation:** Discouragement of potential providers who could offer a credible capability, but may not be able to achieve all of NASA's stated requirements.

Public Outreach for Commercial Activities

- **SHORT DESCRIPTION OF THE PROPOSED RECOMMENDATION:** The NAC Education and Public Outreach and Commercial Space Committees jointly recommend that:
  1. NASA encourage existing Commercial Orbital Transportation Services contractors to work with NASA's Office of Communication to integrate public outreach into mission planning and operations.
  2. NASA Office of Communication draft a recommended commercial partner public outreach and participatory exploration policy (including contingency media/communication plans) to serve as a guideline when developing future partner agreements.

- **MAJOR REASONS FOR THE PROPOSED RECOMMENDATION:** Current Commercial Orbital Transportation Services contracts between NASA and private sector space entities do not include any guidelines to insure reasonable public access to mission activities. The Space Act of 1958 requires NASA to "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof." Public participation in space exploration remains a NASA priority to insure continued funding, recruit talent and inspire interest in STEM education.
- Therefore, it is in the mutual interest of the space agency and its commercial partners to insure the public is granted a "front row seat" to future missions, providing such access is legal and does not compromise the intellectual property rights of the commercial entity, or unnecessarily divert resources away from higher priority mission activities.

Back-up Charts

Observations / Findings / Recommendations

- Observations
  - *Progress of the COTS Program*
- Findings
  - *Use of Space Act Agreements*
- Recommendations
  - *Defining the NASA Market*
  - *Concept of Operations and Acquisition Approach*
  - *FAA Licensing*
  - *Business Case*

Progress of the COTS Program

- Observation (April 28, 2010)
  - The Council observes that the NASA Commercial Orbital Transportation Services (COTS) program to develop and demonstrate commercial capabilities for the delivery of cargo to the International Space Station (ISS) is moving forward at a deliberate pace. The Commercial Space Committee intends to closely follow the progress of the COTS Cargo program and the use of the proposed $312 million in new funding allotted to “incentivize” the program’s participants. The Committee respectfully requests that NASA keep it informed of developments on the program. The committee believes that the Commercial Orbital Transportation Services (COTS) program could be a viable model for the commercial crew program.

Progress of the COTS Program (cont.)

- Rationale
  - Under the Commercial Orbital Transportation Services (COTS) program, NASA has entered into Space Act Agreements with SpaceX and Orbital Sciences to develop and demonstrate commercial capabilities for the delivery of cargo to the International Space Station. One of the participants, SpaceX, has passed critical design review and is expected to conduct the first of three demonstration flights within the next several months. The other participant, Orbital Sciences, began 18 months later and is undergoing critical design review at the present time and will conduct its only demonstration mission in approximately one year. The Committee notes that SpaceX and Orbital Sciences are behind their proposed schedules.
  - The committee believes that the Commercial Orbital Transportation Services (COTS) program could be a viable model for the commercial space program.

Use of Space Act Agreements

- Finding (August 2010)
  - The Council finds that the use of Space Act Agreements (SAAs) is appropriate for the proposed Commercial Crew Transportation program to develop and demonstrate commercial capabilities for the delivery of astronauts to and from the International Space Station. The use of Space Act Agreements is appropriate because the program is envisioned as a public-private partnership, in which both parties provide funding, to develop capabilities that will be owned and operated by the private sector to serve both government and private sector markets. In addition, SAAs allow flexibility in the development of transportation capabilities. Subsequently, for crew transportation services, the use of Federal Acquisition Regulations (FAR) Part 12 commercial services contract is appropriate.

Use of Space Act Agreements (cont.)

- Rationale
  - Other Transaction Authority (OTA) agreements, known as Space Act Agreements within NASA, are used by government agencies to provide funding toward the development of capabilities intended to be used for both government and private purposes, where government is not the sole funding source for the development activity. Currently, NASA is using SAAs on the Commercial Orbital Transportation Services (COTS) program in the same manner, funding two companies – SpaceX and Orbital – for development and demonstration of space systems for the transport of cargo to and from the International Space Station. For actual cargo delivery services, NASA has awarded Federal Acquisition Regulations (FAR) Part 12 commercial services contracts to both companies under the Commercial Resupply Services (CRS) program.
  - OTAs have been used successfully by other government agencies, including DARPA and the Department of Defense. A notable use of OTAs was on the Evolved Expendable Launch Vehicle (EELV) development program, in which the U.S. Air Force provided $500 million to each of two companies for the development of the Atlas V and Delta IV expendable launch systems intended to serve both government and commercial customers. The companies – Boeing and Lockheed Martin – provided approximately $4-5 billion in additional funding above that of the Air Force in order to develop and demonstrate the vehicles. For launch services, the Air Force contracted with both companies under FAR Part 12 for acquisition of commercial services.

Use of Space Act Agreements (cont.)

- Rationale (cont.)
  - A similar public-private partnership is appropriate for the development and demonstration of commercial human spaceflight capabilities because the systems are being designed to meet both NASA's need to transport astronauts to and from the International Space Station, as well as commercial purposes, including flights of astronauts, researchers, and other spaceflight participants to low Earth orbit and other in-space destinations, such as the planned Bigelow Aerospace habitats. Also, funding for the development of these capabilities will come from both NASA and the companies themselves, resulting in the use of public and private funds to meet public and private purposes.

Defining the NASA Market

- Recommendation (August 2010)
  - The Council recommends that NASA assess and clarify NASA's expected traffic model for crew transport to and from the International Space Station (ISS) and other LEO destinations prior to issuing a draft solicitation for the Commercial Crew Transportation program. The number of flights and/or seats per year purchased by NASA on U.S. commercial spaceflight vehicles has a significant impact on the business plans of and availability of private investment for commercial providers. In assessing its needs and opportunities, NASA should consider how the availability of commercial space transportation capabilities could change the concept of operation of the ISS to get the most out of its infrastructure.

Defining the NASA Market (cont.)

- Rationale
  - Understanding the expected NASA market for crew transport to and from the International Space Station has a significant impact on the business plans of and availability of private investment for commercial providers. Whether this number is large or small, clarity in what NASA intends to purchase is foundational for development of solid business plans upon which companies can seek private investment and financing. For example, under the Commercial Orbital Transportation Services (COTS) program, the clear definition of the requirement for cargo transport services provided a solid foundation for the business plans of the commercial bidders.
  - Currently, NASA is flying approximately 40 U.S. and international partner astronauts into space each year, with around 35 flying on five Shuttle flights and six on the Russian Soyuz. This maintains a year-round, on-orbit presence of three U.S. and international partner astronauts on the International Space Station, as well as “surges” of seven astronauts on the Shuttle docked to the Station for periods of 10-15 days. With the retirement of the Space Shuttle, NASA has contracted with the Russian Space Agency to purchase six seats per year to sustain three U.S. and international partner astronauts on the Station for six-month stays.

Defining the NASA Market (cont.)

- Rationale (cont.)
  - In order to provide greater clarity for potential commercial crew providers, NASA should assess the requirements for crew transport to and from the International Space Station for U.S. astronauts and those international partner astronauts for which NASA is obligated to provide transportation. NASA should take into account the following in its assessment:
    - Extension of plans to fund U.S. participation in the International Space Station program from 2015 to "at least 2020."
    - Expected availability of multiple commercial crew transportation providers in the 2015 timeframe.
    - Feasibility of permanent crew sizes higher than six.
    - Crew rotation times other than the current six-month expeditions.
    - The ability of non-NASA funded personnel to access and use the International Space Station, including other national governments, private researchers, and other spaceflight participants.
    - Plans and funding for new capabilities and increased utilization of the International Space Station for research and technology demonstrations.
    - The ability to "surge" for short durations to increase the number of astronauts on Station available for utilization and/or maintenance activities.
    - Factors such as environmental control and life support system capacity, logistics/cargo resupply, and physical volume.

Concept of Operations and Acquisition Approach

- Recommendation (August 2010)
  - The Council recommends that NASA structure the crew transportation service acquisition approach and associated ISS concept of operations to take maximum advantage of the variety of potential commercial transportation capabilities. The Council recommends that future commercial crew transportation service solicitations simply specify the minimum and maximum number of seats to and from the ISS NASA would purchase in a given solicitation. This approach will allow bidders flexibility to structure the offer that best fits the offerer's business model.

Concept of Operations and Acquisition Approach

- Rationale
  - This approach follows one of the most innovative features of the ISS Commercial Resupply Services procurement in that it lets industry respond with capability based offers. Allowing commercial crew service providers to propose the concept of operations, the frequency of launch, and the number of crew to be transported on each launch that best fits their business model will result in a wider selection of choices for NASA to integrate to meet the total ISS need. This approach could result in more effective utilization of the ISS and will facilitate the long term goal of a sustainable and robust commercial LEO transportation industry that can support NASA's long term exploration enterprise.

FAA Licensing

- Recommendation (August 2010)
  - The Council agrees with NASA that Federal Aviation Administration (FAA) licensing of Commercial Crew services should be the "eventual state." The Council recommends that NASA engage the FAA as soon as possible to discuss FAA licensing of Commercial Crew with the goal of providing clarity to potential offerors regarding the regulatory framework for both development and operation of Commercial Crew capabilities.

FAA Licensing (cont.)

- Rationale
  - In planning for the development and use of commercial crew transportation services, NASA has stated that commercial crew launches conducted by the private sector for NASA will be licensed by the FAA in the "eventual state." NASA has not determined when that eventual state will be reached, providing uncertainty regarding the regulatory environment for development and operation of commercial crew capabilities. Prior to reaching the eventual state, it is unclear what the roles of NASA and FAA will be in providing safety and regulatory oversight of commercial crew launches for NASA. Clarity in the regulatory regime is important prior to issuance of a solicitation for the Commercial Crew Transportation program in order for potential offerors and investors to understand the regulatory and business environment for future operations.

  - In order to clarify the regulatory regime prior to the eventual state, NASA needs to engage directly with the FAA leadership in serious discussion to understand the potential impact of the various options on commercial crew activities conducted for NASA and those conducted for non-governmental customers. The Committee does not believe that this engagement has begun at a sufficient level in order to reach clarity on the regulatory regime in a timely manner prior to issuance of a solicitation.

Business Case

- Recommendation (August 2010)
  - The Council recommends that NASA continue to develop internal metrics and milestones to oversee its Commercial Crew Transportation program and associated industry. Appropriate internal experts can then use these tools to measure whether NASA crew needs will be met in a timely and cost effective manner under this program. Among other things, NASA should be aware of the impact of non-human spaceflight markets, such as cargo and traditional spacecraft launch, on the ability of commercial providers to offer viable crew transportation services, the cost, reliability, and safety implications of the overall commercial space transportation business, and the impact of domestic and foreign competition.

Business Case (cont.)

- Rationale
  - The Committee has received inconsistent and incomplete information on how the Commercial Crew Transportation program will be monitored to assure NASA needs will be met. Effective implementation of the program will require ongoing scrutiny of both the commercial crew providers as well as the industry as whole. This will also help NASA communicate its related plans and programs internally and externally as well as provide benchmarks upon which NASA can evaluate the program

Definitions

- Observation
  - Something seen, discovered, witnessed, or learned by the NAC committee during the course of fact-finding or public meetings
  - A PASSIVE outcome or output
  - Example: "The Committee discovered that there is an unfunded mandate that NASA must comply with in the area of X."

- Finding
  - An observation about which the NAC committee wishes to state an opinion
  - A SEMI-ACTIVE outcome or output
  - Example: "The Committee concurs with the current approach NASA is taking to do X."

- Recommendation
  - A course of action being proposed by the NAC committee for NASA consideration and/or implementation in the future
  - An ACTIVE outcome or output
  - Example: "The Committee recommends that NASA form a tiger team to address a critical issue in the area of X."